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## A new genus and species of Ranidae (Amphibia, Anura) from south-western India

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A new genus and species of Ranidae is described from Karnataka and Kerala in south-western India. The new genus appears to belong in the subfamily Dicroglossinae. It shares with the genus *Fejervarya* Bolkay, 1915 the presence of fejervaryan lines on both sides of the belly, but differs from the latter genus in several respects, particularly in possessing a rectal gland at the mouth commissure and a white horizontal band along the upper lip, two characters that are common in the Indian Raninae but otherwise absent in the Dicroglossinae. It appears to be the fifth genus/subgenus of Ranidae endemic of southern India.

### ABBREVIATIONS

*Measurements.* - EL, eye length (eye horizontal diameter); EN, distance from front of eye to nostril; FFTF, distance from maximum incurvation of web between fourth and fifth toe to tip of fourth toe; FL, femur length (from vent to knee); FLL, forelimb length (from elbow to base of outer palmar tubercle); FOL, foot length (from base of inner metatarsal tubercle to tip of fourth toe); FTL, length of fourth toe from basal border of proximal subarticular tubercle; HAL, hand length (from base of outer palmar tubercle to tip of third finger); HL, head length (from back of mandible to tip of snout); HW, head width; IBE, distance between back of eyes; IFE, distance between front of eyes; IMT, length of inner metatarsal tubercle; IN, internarial space; ITL, inner toe length; IUE, minimum distance between upper eyelids; MBE, distance from back of mandible to back of eye; MFE, distance from back of mandible to front of eye; MN, distance from back of mandible to nostril; MTFE, distance from distal edge of metatarsal tubercle to maximum incurvation of web between fourth and fifth toe; MTTF, distance from distal edge



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of metatarsal tubercle to maximum incurvation of web between third and fourth toe; NS, distance from nostril to tip of snout; SL, distance from front of eye to tip of snout; SVL, snout-vent length; TFL, length of third finger from basal border of proximal subarticular tubercle; TFOL, length of tarsus and foot (from base of tarsus to tip of fourth toe); TFTF, distance from maximum incurvation of web between third and fourth toe to tip of fourth toe; TL, tibia length; TW, maximum "tibia" (actually shank) width; TYD, maximum tympanum diameter; TYE, tympanum-eye distance; UEW, maximum width of upper eyelid.

*Museums, collections and persons.* – AD, Alain Dubois; AMO, Annemarie Ohler; BMNH, Natural History Museum, London, United Kingdom; FMNH, Field Museum of Natural History, Chicago, Illinois, USA; MNHN, Muséum National d'Histoire Naturelle, Paris, France; MSNG, Museo Civico di Storia Naturale Giacomo Doria, Genova, Italy; MV, Michael Veith collection, Mainz, Germany; NMW, Naturhistorisches Museum, Wien, Austria; SDB, S. D. Biju; TBGRI, Tropical Botanic Garden and Research Institute, Thiruvananthapuram, Kerala, India; ZSI/SRS, Zoological Survey of India, Southern Regional Station, Madras, Tamil Nadu, India.

## INTRODUCTION

Southern India, especially in its western part (Western Ghats or Sahyadris), is one of the richest biogeographic areas of the Oriental region. MYERS (1990) identified the Western Ghats as one among the 18 biodiversity hotspots of our planet. The amphibian fauna of this region is rich both in terms of species number and endemism (INGER et al., 1987; BIJU, 2000). It also contains several endemic genera, in particular of the family Ranidae Rafinesque-Schmaltz, 1814 (sensu DUBOIS, 1992, i.e. including the Rhacophorinae Hoffman, 1932 as a subfamily) or epifamily Ranoidea (sensu VENCES & GLAW, 2001, i.e. including a family Ranidae and a family Rhacophoridae). In a traditional approach, supported by the latter proposal, the taxon Ranidae is understood as including only groups that lack intercalary elements between the penultimate and last phalanx of digits.

According to the highly provisional current working taxonomy of this family (see DUBOIS, 1999), the endemic ranid genera of the Western Ghat ranges include *Indirana* Laurent, 1886, *Micrixalus* Boulenger, 1888 and *Nyctibatrachus* Boulenger, 1882, three genera which belong in three different subfamilies. The genus *Indirana* is a member (and currently only genus; see BOSSUYT & MILINKOVICH, 2000, and VENCES et al., 2000b) of the Ranixalinae Dubois, 1987 (type-genus *Ranixalus* Dubois, 1986, a junior subjective synonym of *Indirana*; see DUBOIS, 1987b; subfamily sometimes incorrectly referred to as Indiraninae Blommers-Schlösser, 1993; see DUBOIS, 1999). The genus *Micrixalus* is the type-genus and only genus of the subfamily Micrixalinae (see BOSSUYT & MILINKOVICH, 2001); the nomen of the latter taxon, published without any diagnosis, is a nomen nudum (ANONYMOUS, 1999a); in tab. 1, we provide a diagnosis for this taxon. Finally, the genus *Nyctibatrachus* (synonym *Nannobatrachus* Boulenger, 1882; see DUBOIS, 1987a) is the type-genus and only genus of the subfamily Nyctibatrachinae Blommers-Schlösser, 1993 (see BLOMMERS-SCHLÖSSER, 1993; VENCES et al., 2000b).

In southern India, the nominative subfamily Raninae also occurs. It is represented there by a few species traditionally referred to the genus *Rana* Linnaeus, 1758, by some authors

(e.g., BOULENGER, 1920; DUTTA, 1997) to the subgenus *Hylarana* Tschudi, 1838 of this genus, and by DUBOIS (1992) to three provisional subgenera of this genus, two of which (*Hydrophylax* Fitzinger, 1843 and *Sylvirana* Dubois, 1992) also occur in other regions, but the third of which (*Clinotarsus* Mivart, 1869) is also an endemic of southern India.

We here report on the existence of a fifth group that also appears to be endemic of southern India, and that belongs to a fifth provisional subfamily of Ranidae, the Dicroglossinae Anderson, 1871. Before proceeding further, a few words are necessary concerning the tribal taxonomy of this subfamily. DUBOIS (1992) recognized four tribes in the latter: an African one with tadpoles (Conrauii Dubois, 1992), and three mostly Asian and Oriental ones, one with direct developing genera (Ceratobatrachini Boulenger, 1884), and two with tadpoles (Dicroglossini and Limnnectini Dubois, 1992). Recent data, especially molecular, lead to a re-evaluation of this taxonomy. First of all, MARMAYOU et al. (2000) showed that the genera *Occidozyga* Kuhl & Van Hasselt, 1822 and *Phrynoglossus* Peters, 1867 should be excluded from this subfamily, but the genus *Euphlyctis* Fitzinger, 1843, which is cladistically closely related to *Hoplobatrachus* Peters, 1863 and several other genera (BOSSUYT & MILINKOVITCH, 2000; VENCES et al., 2000a-b; KOSUCH et al., 2001) should be maintained in the Dicroglossinae; therefore the subfamily including the genera *Occidozyga* and *Phrynoglossus* should be called Occidozyginae Fei, Ye & Huang, 1991 (see DUBOIS, 1992). Secondly, a whole set of concordant data (BOSSUYT & MILINKOVITCH, 2000; EMERSON et al., 2000; MARMAYOU et al., 2000; VENCES et al., 2000a-b; KOSUCH et al., 2001; DELORME et al., submitted) suggest that at least three clades exist among Asian and Oriental Dicroglossinae. The first clade, for which the nomen Dicroglossini is available, includes the genera *Euphlyctis* Fitzinger, 1843, *Fejervarya* Bolkay, 1915, *Hoplobatrachus*, *Nannophrys* Günther, 1869 and *Sphaerotheca* Günther, 1859. The second clade includes one genus with tadpoles, *Limnnectes* Fitzinger, 1843, and one with direct development, *Taylorana* Dubois, 1987. MARMAYOU et al. (2000) showed that the origin of direct development was independent in the latter genus and in the genus *Philautus* Gistel, 1848 (Rhacophorinae/dae), but they did not study the cladistic relationships of the other direct developing genera placed by DUBOIS (1992) in the Ceratobatrachini. In a recent work, DELORME et al. (submitted) provided evidence that at least two of these genera (*Ceratobatrachus* Boulenger, 1884 and *Ingerana* Dubois, 1987) were not closely related to *Limnnectes* and *Taylorana*, nor to the other Dicroglossinae, and deserve recognition as an independent clade, for which the nomen Ceratobatrachinae is available. In the absence of additional evidence, we here transfer the genus *Taylorana* to the Limnnectini, but we maintain all other developing genera in the Ceratobatrachinae. This is however a provisional solution, until the cladistic position of all of them has been ascertained, as some of them might later prove to belong in fact in the Limnnectini. Finally, the data of DELORME et al. (submitted) also suggest that the group recognized by DUBOIS (1992) as a tribe Paini of the Raninae should be transferred to the Dicroglossinae, as a fourth tribe (including species that differ from those of all other tribes of this subfamily by their unforked omosternum). The subfamilial and tribal classification of the Ranidae will be discussed in more detail elsewhere (DUBOIS & OHLER, in preparation), but for the time being we just provide in tab. 1 some major diagnostic morphological characters for the five subfamilies mentioned above and for the two Asian tribes of Dicroglossinae with forked omosternum that include species with tadpoles (Dicroglossini and Limnnectini). The data summarized in this table will be useful to establish the place of the new taxon described below in the Ranidae.

Table 1. – Some diagnostic morphological characters of three subfamilies of the family Ranidae present in southern India. See GRANT et al. (1997) for a definition and discussion of the median lingual process. See DUBOIS (1995) for the definition of the tadpole's condensed collective keratodont formula (CCKF), i.e. minimum-maximum numbers of keratodont rows on upper/lower lips of tadpoles observed in the taxon. In "generic contents", genera present in southern India are marked with an asterisk.

Subfamily	Dicoglossinae Anderson, 1871	Dicoglossinae Anderson, 1871	Micrixalinae subfam. nov.
Tribe	Dicoglossini Anderson, 1871	Limnnectini Dubois, 1992	–
Type-genus	<i>Dicoglossus</i> Günther, 1860 (junior subjective synonym of <i>Euphyctis</i> Fitzinger, 1843)	<i>Limnnectes</i> Fitzinger, 1843	<i>Micrixalus</i> Boulenger, 1888
Generic contents	<i>Euphyctis</i> * Fitzinger, 1843; <i>Fejervarya</i> * Bolkay, 1915; <i>Hoplobatrachus</i> * Peters, 1863; <i>Nannophrys</i> Günther, 1869; <i>Sphaerotheca</i> * Günther, 1859	<i>Limnnectes</i> Fitzinger, 1843; <i>Taylorana</i> Dubois, 1987	<i>Micrixalus</i> * Boulenger, 1888
Base of omosternum	Forked	Forked	Unforked
Vomerine teeth	Present	Present	Absent
Median lingual process	Absent	Absent	Present or absent
Digital disks	Absent	Absent or present	Present
Femoral glands	Absent or present	Absent	Absent
Vocal sacs in male	Present	Present or absent	Present
Nuptial pads in males	Present or absent	Absent	Present
Tadpole type	Aquatic or terrestrial	Aquatic or direct development	Aquatic
Tadpole's CCKF	1-5/2-6	1-3/2-3	1/0
References for characters	BOLKAY, 1915; DECKERT, 1938; LAURENT, 1950; KIRTISINGHE, 1958; CLARKE, 1981, 1983; DUBOIS, 1987a, 1992; FEI, 1999	DECKERT, 1938; LAURENT, 1986; DUBOIS, 1987a, 1992; FEI, 1999	BOULENGER, 1882, 1890; SMITH, 1924; DECKERT, 1938; MYERS, 1942b; INGER et al., 1984; DUBOIS, 1987a, 1992

Table 1. (continued)

Subfamily	Nyctibatrachinae Blommers-Schlösser, 1993	Raninae Rafinesque-Schmaltz, 1814	Ranixalinae Dubois, 1987
Tribe	—	Ranini Rafinesque-Schmaltz, 1814	—
Type-genus	<i>Nyctibatrachus</i> Boulenger, 1882	<i>Rana</i> Linnaeus, 1758	<i>Ranixalus</i> Dubois, 1986 (junior subjective synonym of <i>Indirana</i> Laurent, 1986)
Generic contents	<i>Nyctibatrachus</i> * Boulenger, 1882	<i>Amolops</i> Cope, 1865; <i>Batrachylodes</i> Boulenger, 1887; <i>Nanorana</i> Günther, 1896; <i>Rana</i> * Linnaeus, 1758; <i>Staurois</i> Cope, 1865	<i>Indirana</i> * Laurent, 1986
Base of omosternum	Forked	Unforked	Forked
Vomerine teeth	Present	Present	Present
Median ligual process	Present	Absent	Present
Digital disks	Present	Absent or present	Present
Femoral glands	Present	Absent	Present
Vocal sacs in male	Absent	Present	Present or absent
Nuptial pads in males	Present	Present or absent	Present
Tadpole type	Aquatic	Aquatic	Terrestrial
Tadpole's CCKF	0/0	1-12/2-9	3-5/3-4
References for characters	BOULENGER, 1882, 1890; ANNANDALE, 1918, 1919; MYERS, 1942a; BHADURI & KRIPALANI, 1955; PILLAI, 1978; INGER et al., 1984; DUBOIS, 1987a, 1992; SHAFFER, 1988	DUBOIS, 1992	ANNANDALE, 1918; BOULENGER, 1920; RAO, 1920; INGER et al., 1984; LAURENT, 1986; DUBOIS, 1987a, 1992; SEKAR, 1992; BLOMMERS- SCHLÖSSER, 1993

## MATERIAL AND METHODS

Specimens were collected in the field, fixed in 4 % formalin shortly after capture and stored in 70 % ethanol. The list of specimens examined and measured is given below under the description of the new species and in app. 1 for all other specimens, belonging to other species, used as comparative material.

Thirty-two measurements of adult and young specimens were taken by AMO with a slide calliper to the nearest 0.1 mm, or, for values below 5 mm, with an ocular micrometer to the nearest 0.01 mm. The list of measurements is given above under *Abbreviations*.

In order to facilitate comparisons, the description's methodology and plan were the same as those used in previous works on Asian anurans (DUBOIS & OHLER, 1998, 1999, 2000; OHLER & DUBOIS, 1999; BOSSUYT & DUBOIS, 2001; VEITH et al., 2001). The webbing formula is given according to MYERS & DUELLMAN (1982) and the tadpole keratodont formula according to DUBOIS (1995). A male specimen (MNHN 2000.3033) was partially dissected to ventrally examine the pectoral girdle. Drawings of an adult were made by AMO using a camera lucida (Wild Heerbrugg type 256576).

Morphometrical analyses and graphs were made using the SPSS statistical programs for personal computers (NORUSIS, 1992; ANONYMOUS, 1999b). We used principal component analysis with varimax rotation (ANONYMOUS, 1999b: 426) to show morphological distinctiveness of the new genus and canonical discriminant analysis to indicate morphological discrimination from *Fejervarya* and *Sphaerotheca*. One-way Tukey type b tests were performed on ranked ratios of all measurements between the six genera of Dicroglossinae. Detailed results of this analysis can be communicated upon request by the first authors, but are not given here because of space limitations.

## RESULTS AND DISCUSSION

The data presented in detail below suggest that the new taxon discussed here is a new species that is the first known representative of a new genus of the Dicroglossinae Dicroglossini. We provide below a definition of the genus, followed by a comparison with other genera and a discussion of its relationships, and a detailed description of the species.

### *Minervarya* gen. nov.

*Type-species.* – *Minervarya sahyadris* sp. nov.

*Diagnosis.* – Size small (SVL 17.6-19.2 mm in adult males, 20.6-23.0 mm in adult females); omosternum forked at base; vomerine teeth present; median lingual process absent; rictal gland present; digital extremities rounded, not dilated; webbing rudimentary; inner metatarsal tubercle very short and conical; external metatarsal tubercle present; tarsal ridge present; femoral glands absent; dorsal skin with longitudinal folds; lateral-line system absent in adult; fejervaryan lines present; upper lip with white horizontal band; nuptial pads present on prepollex and finger I of breeding male; vocal sac present, marked by glandular skin on middle of throat of adult male; aquatic tadpole with a keratodont formula of 2/3, keratodont rows simple; eggs of rather small size, white and brown colored.

*Phenetic comparisons.* – The combination of character states of the diagnosis above clearly excludes *Minervarya* from all subfamilies and tribes listed in tab. 1, except the tribe Dicroglossini of the Dicroglossinae. The tribes Conrauiini and Paini can also be readily excluded,

the first one, among other characters, because of the keratodont formula of its tadpoles (CCKF 7-8/6-11; LAMOTTE & PERRET, 1968), and the second one, among other characters, by its unforked omosternum (DUBOIS, 1975, 1992). As a result of these comparisons, we propose to place the new genus in the tribe Dicroglossini. However, comparisons of the new species with the five genera referred here to this tribe point to the uniqueness of this species, that suggests that it belongs to a new, distinct genus.

The endemic Sri Lankan genus *Nannophrys* can readily be excluded from these comparisons, not only because of the very peculiar morphology of the adult, that has nothing to do with that of the new taxon (see e.g. KIRTISINGHE, 1957; CLARKE, 1983; DUTTA & MANAMENDRA-ARACHCHI, 1996), but also of its very peculiar tadpole (KIRTISINGHE, 1958). Remain four genera (tab. 1), all of which do occur in southern India, for which we provide detailed comparisons in tab. 2. For more security, in this table we also extended comparisons to the genus *Limnonectes*, that was placed by DUBOIS (1992) in the same tribe as *Fejervarya* and *Hoplobatrachus*, and to the three subgenera of *Rana* that are known to occur in southern India.

The data of tab. 2 show clearly that the new taxon does not fit by its combination of characters with any of the four other genera of Dicroglossini. Among them, of particular relevance is a comparison with the genus *Fejervarya*, with which it shares a rare character, the presence of fejervaryan lines (as defined by DUBOIS & ÖHLER, 2000: 35) on both sides of the belly (fig. 7). But the new taxon differs from the genus *Fejervarya* in several other important characters. In particular, the presence in this taxon of a rictal (mandibular) gland just posterior to the corner of the mouth (fig. 5) is unique in the subfamily Dicroglossinae, while this character is common in the subfamily Raninae (personal observations), including the Indian subgenera of *Rana* (fig. 6; tab. 2). Another important difference is the coloration of the upper lip of the adults (bright white) (fig. 5), that is not to be found in any other Dicroglossinae but is common in the Raninae, including the Indian subgenera of *Rana* (fig. 6; tab. 2). However, the forked omosternum of the new genus definitely excludes it from the Raninae as currently understood.

*Minervarya* differs from *Fejervarya* by the two characters mentioned above, and by its smaller adult size, the proportions of its head and hindlimbs, the aspect of its dorsal folds and of its vocal sacs. Beside the presence of fejervaryan lines and of rictal glands and the coloration of its upper lip, the new genus differs from all other Dicroglossinae, and in particular of Dicroglossini, by a number of characters (see tab. 1-2), among which only the most striking ones need to be mentioned here: from *Euphlyctis*, the new genus differs by its size, skin structure, webbing and tadpole's CCKF; from *Hoplobatrachus*, it differs by its size, webbing and tadpole's characters; from *Sphaerotheca*, it differs by its size, dorsal skin, shape of internal metatarsal tubercle and absence of femoral glands; from *Nannophrys*, it differs by its general shape and the whole morphology of tadpoles; finally, from *Limnonectes* (a genus member of the tribe Limnnectini of the Dicroglossinae), *Minervarya* differs by its size, undilated digital tips, webbing and presence of nuptial pads in adult breeding males.

*Multivariate comparisons.* – Morphometric data also confirm the uniqueness of this taxon. In several zoological groups, genera can be viewed as "shape groups", among which species are more similar in shape than with species of other genera (LEMEN & FREEMAN, 1984; DUBOIS, 1988a-b). This is particularly true in anuran amphibians, where morphometric differences

Table 2. – Some diagnostic morphological characters of nine genera or subgenera of the subfamilies Dicroglossinae and Raninae of the family Ranidae. See OHLER & DUBOIS (1989) for a definition of the different kinds of digital discs recognized here.

Genus	<i>Minervarya</i> gen. nov.	<i>Fejervarya</i> Bolkay, 1915	<i>Sphaerotheca</i> Günther, 1859
Adult male SVL	17-20	25-80	30-55
Adult female SVL	20-23	30-90	35-60
Head proportions (HW:HL)	Longer than wide	Longer than wide	Shorter than wide
Rictal gland	Present	Absent or present	Absent or present
Digit tips	Rounded	Pointed	Rounded
Webbing on feet	Rudimentary	Small to medium	Small
Internal metatarsal tubercle	Rather long, cylindrical	Long and narrow, cylindrical or shovel-shaped	Short, shovel-shaped
External metatarsal tubercle	Present	Absent or present	Absent
Tarsal ridge	Absent	Faint and short, or absent	Absent
Dorsal skin	With several longitudinal folds	With numerous longitudinal folds	Smooth
Upper lip coloration	With white horizontal band	With vertical brown bars	With vertical brown bars
Dorsal chevron	Absent	Present or absent	Absent
Shoulder spots	Absent	Present or absent	Present or absent
Tympanum coloration	Dark brown with its inferior border white	Dark spot on upper posterior part	Uniform or marbled, no distinct spot
Lateral line system in adult	Absent	Absent	Absent
Fejervaryan lines	Present	Present	Absent
Femoral glands	Absent	Absent	Present
Vocal sacs in male	Marked by darker coloration and skin differentiation on throat and chest	Marked by darker coloration, and sometimes also by longitudinal folds, on sides of throat	Marked by darker coloration and folds on sides of throat
Nuptial pads in male	Present on prepollex and finger I	Present on prepollex and finger I	Present on prepollex and finger I
Humeral glands in males	Absent	Absent	Absent
Tadpole's CCKF	2/3	2/3	2/3
Keratodont rows	Simple	Simple	Simple
References for characters	This paper	BOULENGER, 1920; DUBOIS & OHLER, 2000; VEITH et al., 2001	BOULENGER, 1920; KIRTISINGHE, 1958; DUTTA & MANAMENDRA- ARACHCHI, 1996



Table 2. (continued)

Genus	<i>Euphylys</i> Fitzinger, 1843	<i>Hoplobatrachus</i> Peters, 1863	<i>Limnometes</i> Fitzinger, 1843
Adult male SVL	40-95	75-130	35-150
Adult female SVL	45-130	65-140	35-135
Head proportions (HW:HL)	As wide as long	As wide as long	As wide as long
Rictal gland	Absent	Absent	Absent
Digit tips	Pointed	Rounded	Rounded and dilated, sometimes with dorso- terminal grooves
Webbing on feet	Complete	Large	Medium to large
Internal metatarsal tubercle	Pointed, cylindrical, digit-like	Rather long, cylindrical or shovel-shaped	Rather long, cylindrical
External metatarsal tubercle	Absent	Absent	Absent
Tarsal ridge	Faint or absent	Long, distinct	Present, usually faint, or absent
Dorsal skin	Smooth with horny granules	With numerous longitudinal folds	Smooth or with longitudinal folds
Upper lip coloration	With or without vertical brown bars	With vertical brown bars	Without special coloration
Dorsal chevron	Absent	Absent	Present or absent
Shoulder spots	Absent	Absent	Absent
Tympanum coloration	Uniform, light	Uniform, light	Uniform or with an indistinct darker spot
Lateral line system in adult	Present	Absent	Absent
Fejervaryan lines	Absent	Absent	Absent
Femoral glands	Absent	Absent	Absent
Vocal sacs in male	Dark-coloured, projecting through two slits on sides of throat	Marked by colour and longitudinal folds on sides of throat	Present or absent
Nuptial pads in male	Absent	Present on prepollex and finger I	Absent
Humeral glands in males	Absent	Absent	Absent
Tadpole's CCKF	1/2	2-5/3-6	1-3/2-3
Keratodont rows	Simple	Double	Simple
References for characters	BOULENGER, 1920; KIRTISINGHE, 1958; DUTTA & MANAMENDRA- ARACHCHI, 1996	BOULENGER, 1920; DUBOIS, 1992; FEI, 1999; KOSUCH et al., 2001	BOULENGER, 1920, BOURRET, 1942; INGER, 1966, 1985; OHLER & DUBOIS, 1999

Table 2. (continued)

Genus	<i>Rana</i> Linnaeus, 1758	<i>Rana</i> Linnaeus, 1758	<i>Rana</i> Linnaeus, 1758
Subgenus	<i>Clinotarsus</i> Mivart, 1869	<i>Hydrophylax</i> Fitzinger, 1843	<i>Sylvirana</i> Dubois, 1992
Adult male SVL	42-55	59-65	34-80
Adult female SVL	63-85	40-70	30-83
Head proportions (HW:HL)	As wide as long or wider than long	As wide as long	As wide as long or longer than wide
Rictal gland	Absent	Present	Present
Digit tips	Rounded and dilated, sometimes with indistinct latero-ventral groove	Rounded and slightly dilated	Rounded and dilated, usually with latero-ventral groove
Webbing on feet	Large	Medium	Medium or large
Internal metatarsal tubercle	Rather long, oval, very prominent	Rather long, oval, very prominent	Rather short, oval or elliptic
External metatarsal tubercle	Absent	Present	Present
Tarsal ridge	Absent	Absent	Absent
Dorsal skin	Smooth, with dorso-lateral folds	Smooth or granular, with indistinct dorso-lateral folds	Smooth, with dorso-lateral folds
Upper lip coloration	With a blackish margin	With white horizontal band	With white horizontal band
Dorsal chevron	Absent	Absent	Absent
Shoulder spots	Absent	Absent	Absent
Tympanum coloration	Uniform, dark	Uniform, light-colored	Uniform, light-colored
Lateral line system in adult	Absent	Absent	Absent
Fejervaryan lines	Absent	Absent	Absent
Femoral glands	Absent	Absent	Absent
Vocal sacs in male	Present	Present	Present
Nuptial pads in male	Present on prepollex and finger I	Present on prepollex and finger I	Present on prepollex and finger I
Humeral glands in males	Absent	Present	Present
Tadpole's CCKF	8/6-8	1/2-3	1-2/2-3
Keratodont rows	Simple	Simple	Simple
References for characters	BOULENGER, 1920; CHARI, 1962	ANDERSSON, 1937; CHARI, 1962	BOULENGER, 1920; KIRTISINGHE, 1957; DUBOIS, 1992, DUTTA & MANAMENDRA-ARACHCHI, 1996

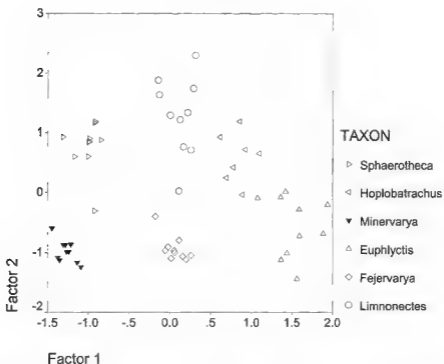


Fig. 1 Plots of factors 1 and 2 of principal component multivariate analysis based on varimax rotated coefficients from log-transformed characters (25 measurements) for the following genera *Euphlyctis*, *Fejervarya*, *Hoplobatrachus*, *Limnonectes*, *Minervarya* and *Sphaerotheca*.

between species within genera are often very slight, if not absent, while differences between genera are often very clear-cut, thus allowing generic allocation of isolated species or individuals (HEYER, 1994; OHLER, 1996; DUBOIS & OHLER, 1999; VEITH et al., 2001), or recognition of new genera (DUBOIS, 1980; OHLER, 1999). The validity of this approach is once again confirmed in this study (tab. 3). As shown in fig. 1, the first and second factors of the principal component analysis based on 25 measurements sorted all genera of Dicroglossini, and also *Limnonectes*, as discrete groups. The new taxon appears as a new, discrete group, quite distinct from the other five groups, at least as distinct as they are between themselves. Morphologically it is closest to *Fejervarya* and *Sphaerotheca*. A discriminant analysis including these three genera (tab. 4, fig. 2) allowed to show that the measurements that best explain variation between groups are size, head shape, hind leg length and webbing.

One-way analysis including all six genera showed significant differences of the new genus in all but two measurements (HAL, TFL) to at least one of the other genera. The new taxon is the smallest species (SVL), it has the largest internarial distance (IN) and the shortest metatarsal tubercle (IMT). The new genus can be distinguished from *Fejervarya* by its wider head as expressed by IFE and IBE, its shorter head measurements (MFE, EN), larger eyes

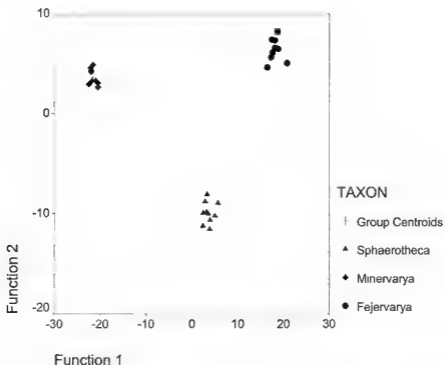


Fig 2 Plots of canonical discriminant function scores using minimization of Wilk's lambda of morphometric log transformed characters (25 measurements) for the genera *Fejervarya*, *Minervarya* and *Sphaerotheca*

(EL), shorter shank (TL), foot (FOL) and inner toe (ITL), and its reduced webbing (MTTF, MTFF). It can be differentiated from *Lammonectes* by its narrower (HW) and shorter (HL, MN, MBE, EN, TYE) head, its shorter forearm (FLL), shank (TL) and inner toe (ITL), but its longer fourth toe (FTL), and more reduced webbing (MTTF, MTFF, TFTE, FTFF). It differs from *Hoplobatrachus* by its head shape (MFE, IFE, IBE, TYE), its longer fourth toe (FTL), larger eyes (EL) and reduced webbing (MTTF, MTFF, TFTE, FTFF). It is distinguished from *Euphyllis* by its wider head (IFE, IBE), larger eyes (EL) and reduced webbing (MTTF, MTFF, TFTE, FTFF). The morphological differences to *Sphaerotheca* are its narrower (HW, I-E) and longer head (MFE, MN, EN), longer shank (TL), foot (FOL) and fourth toe (FTL), and its reduced webbing (TFTE, FTFF).

*Cladistic relationships* As mentioned above, two important characters of the new taxon are not to be found in any known member of the Dicroglossinae but are common in the Raninae: (1) the presence of a rectal gland; (2) the coloration of the upper lip (bright white). However, these two characters are not unique to the Raninae, but can be observed in various other anuran taxa, where they probably appeared by convergence. On the other hand, the forked omosternum of the new species excludes it from the Raninae as currently understood. For the

Table 3. – Results of principal component analysis based on varimax rotated coefficients from log-transformed characters (25 measurements) for specimens referred to the genera *Euphlyctis*, *Fejervarya*, *Hoplobatrachus*, *Limnonectes*, *Minervarya* and *Sphaerotheca*.

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	22.639	90.558	90.558
2	0.799	3.196	93.754
3	0.696	2.783	96.537

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	10.152	40.610	40.610
2	9.597	38.390	78.999
3	4.384	17.538	96.537

Variable	Components for rotated component matrix		
	1	2	3
SVL	0.649	0.621	0.422
HW	0.617	0.706	0.337
HL	0.673	0.647	0.340
MN	0.667	0.646	0.330
MFE	0.649	0.674	0.322
MBE	0.639	0.683	0.312
IFE	0.505	0.768	0.371
IBE	0.553	0.757	0.368
FLL	0.589	0.682	0.419
HAL	0.661	0.653	0.346
TL	0.732	0.530	0.410
FOL	0.709	0.534	0.456
IN	0.235	0.817	0.471
EN	0.698	0.592	0.353
EL	0.599	0.691	0.351
TYD	0.712	0.487	0.367
TYE	0.449	0.773	0.223
TFL	0.654	0.635	0.364
FTL	0.757	0.415	0.484
MTTF	0.836	0.453	0.299
TFTF	0.349	0.349	0.859
MTFF	0.830	0.463	0.297
FFTF	0.432	0.402	0.788
IMT	0.419	0.797	0.293
ITL	0.873	0.304	0.283

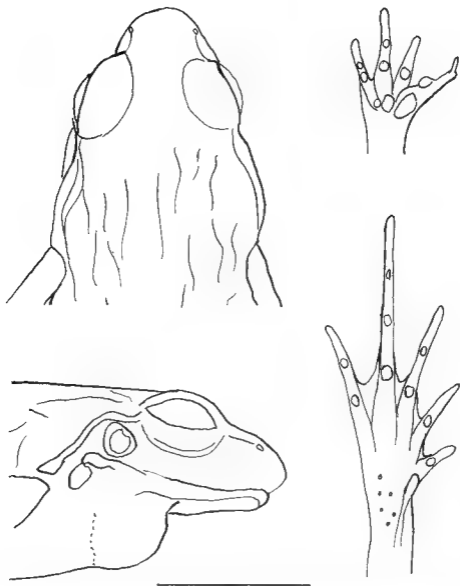


Fig 3 Holotype of *Mimervarva saltyadris*, MNHN 2000 3031, adult male (SVL 19.1 mm) Top left, head from above, top right, right hand from below, bottom left, head from right side, bottom right, right foot from below

Table 4 - Results of canonical discriminant analysis between specimens referred to the genera *Fejervarya*, *Minervarya* and *Sphaerotheca*.

## A. Statistical significance

Eigenvalue	Canonical correlation	Wilks Lambda	Chi-square	Degrees of freedom	P
298.016	0.998	0.000	146.265	50	0.000
56.426	0.991	0.017	60.757	24	0.000

## B Standardized canonical discriminant function coefficients

Morphometric character	Function		Morphometric character	Function	
	1	2		1	2
SVL	-5.472	-0.465	FTL	-0.092	-3.222
HW	2.411	-1.235	IN	-6.213	2.296
HL	5.586	-1.868	EN	0.992	0.957
MN	-4.922	1.529	EL	3.284	-2.374
MFE	1.366	2.573	TYD	3.701	-2.020
MBE	-0.320	-2.749	TYE	2.179	-0.410
IFE	-0.381	-1.919	MTF	-2.364	3.692
IBE	-0.339	1.960	MTFF	4.273	2.344
FLL	-1.372	-0.188	TFTF	-6.194	3.013
HAL	2.392	0.982	FFTF	2.974	1.112
TFL	-1.859	-0.410	IMT	-3.768	-0.743
TL	5.544	-3.821	ITL	-0.309	1.055
FOL	-0.443	-0.878			

## C. Classification success

Actual group	Predicted group membership		
	<i>Fejervarya</i>	<i>Minervarya</i>	<i>Sphaerotheca</i>
<i>Fejervarya</i>	10 (100%)	0	0
<i>Minervarya</i>	0	10 (100%)	0
<i>Sphaerotheca</i>	0	0	10 (100%)

Table 5 - Some measurements and ratios of 6 adult males (the holotype\* and 5 paratypes) of *Minervarya sahyadris* from the type-locality Gundia in Karnataka and two localities in Kerala (Mukkam, Thiruvapady). SVL is given in mm, all other measurements are given as per thousands of SVL. Values given in the last two columns, mean  $\pm$  standard deviation (range).

Collection number	MNHN 2000 3030	MNHN 2000 3031*	MNHN 2000 3033	TBGR1 2001 0006	TBGR1 2001 0007	MNHN 2000 3036	Total 3 adult males from Karnataka	Total 3 adult males from Kerala
Locality	Gundia	Gundia	Gundia	Mukkam	Mukkam	Thiruvapady	Gundia	Mukkam + Thiruvapady
SVL	18.9	19.1	18.0	17.2	18.5	19.0	18.7 $\pm$ 0.59 (18.0-19.1)	18.2 $\pm$ 0.93 (17.2-19.0)
HW	344	319	317	366	341	358	327 $\pm$ 15.0 (317-344)	355 $\pm$ 13.1 (341-366)
HL	365	393	428	448	384	374	395 $\pm$ 31.4 (365-428)	402 $\pm$ 40.1 (374-448)
MN	357	353	371	428	357	331	360 $\pm$ 6.6 (353-371)	372 $\pm$ 50.4 (331-428)
MFI	295	282	292	359	291	266	289 $\pm$ 6.8 (282-295)	305 $\pm$ 48.2 (266-359)
MBE	178	153	173	206	172	147	168 $\pm$ 13.4 (153-178)	175 $\pm$ 29.9 (147-206)
IFE	199	170	180	211	196	194	183 $\pm$ 14.9 (170-199)	200 $\pm$ 9.2 (194-211)
IBE	285	258	267	302	281	293	270 $\pm$ 13.5 (258-285)	292 $\pm$ 10.7 (281-302)
FLL	209	186	205	234	217	225	200 $\pm$ 12.1 (186-209)	225 $\pm$ 8.2 (217-234)
HAL	223	207	194	237	238	232	208 $\pm$ 14.2 (194-223)	236 $\pm$ 3.3 (232-238)
TFL	96	119	112	132	133	140	109 $\pm$ 11.8 (96-119)	135 $\pm$ 4.4 (132-140)
TL	434	424	428	459	465	458	429 $\pm$ 4.9 (424-434)	461 $\pm$ 3.7 (458-461)
FOL	534	456	483	494	486	537	491 $\pm$ 40.0 (456-534)	506 $\pm$ 27.1 (486-537)
FTL	336	298	263	316	301	331	299 $\pm$ 36.6 (263-336)	316 $\pm$ 15.0 (301-331)
IN	96	92	106	105	101	100	98 $\pm$ 7.2 (92-106)	102 $\pm$ 2.4 (100-105)
EN	76	68	92	78	74	75	78 $\pm$ 12.0 (68-92)	76 $\pm$ 2.0 (74-78)
EL	137	139	129	141	135	133	135 $\pm$ 5.1 (129-139)	136 $\pm$ 4.5 (133-141)
TYD	69	61	61	67	57	69	64 $\pm$ 4.6 (61-69)	64 $\pm$ 6.2 (57-69)
TYE	21	20	29	20	25	25	23 $\pm$ 5.1 (20-29)	23 $\pm$ 3.1 (20-25)
IMT	41	38	43	40	39	41	41 $\pm$ 2.9 (38-43)	40 $\pm$ 1.1 (39-41)
ITL	102	83	84	99	99	93	90 $\pm$ 10.6 (83-102)	97 $\pm$ 3.6 (93-99)
MTTF	202	173	177	188	186	187	184 $\pm$ 15.8 (173-202)	187 $\pm$ 1.2 (186-188)
MTFF	202	176	180	188	189	191	186 $\pm$ 13.9 (176-202)	190 $\pm$ 1.4 (188-191)
TFTF	305	302	263	302	291	331	290 $\pm$ 23.7 (263-305)	308 $\pm$ 20.8 (291-331)
FTFF	315	312	277	320	305	334	302 $\pm$ 21.1 (277-315)	320 $\pm$ 14.7 (305-334)



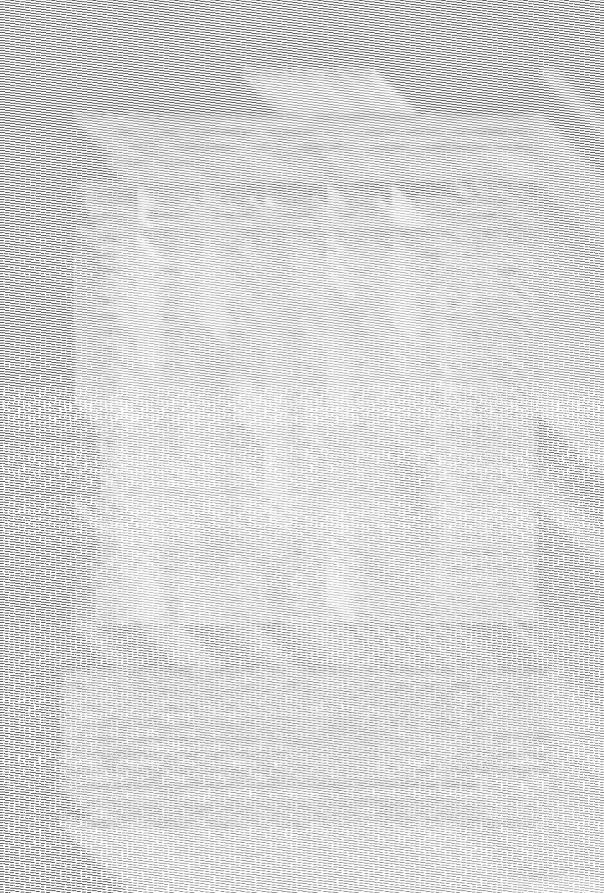




Fig 4 A male specimen of *Minervarya sahyadris* (paratype, TBGRI 2001 0002) photographed in life on 24 August 1999 at Makkam, Kozhikodu District, Kerala (photo S. D. Biju)

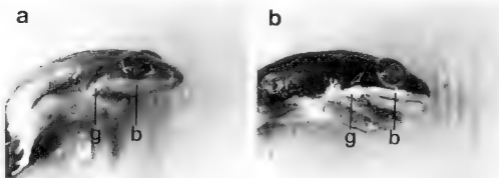


Fig 5 Lateral view of head and body of *Minervarya sahyadris*: (a) MNHN 2000 3031, adult male, holotype, Gundia, Karnataka, (b) TBGRI 2001 0007, adult male, Makkam, Kerala. b, white band on upper lip, g, rectal gland.

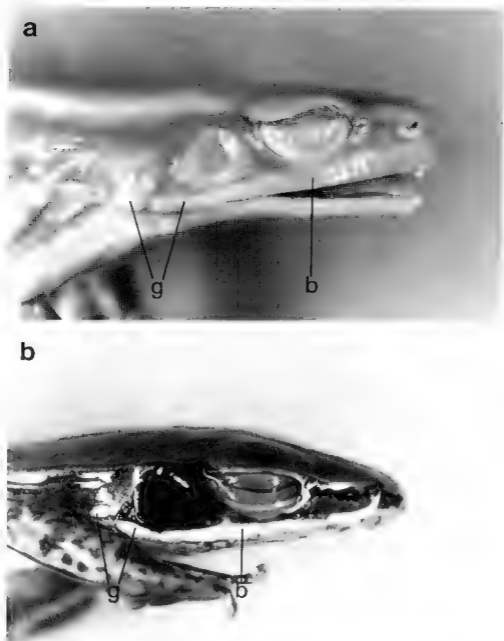


Fig 6 Lateral view of head and body of (a) *Rana (Hydrophylax) malabarica*, MNHN 771, adult female, syntype, Malabar, India (b) *Rana (Sylvirana) temporalis*, MNHN 2000 0613, adult male, Kitulgala, Sri Lanka. b, white band on upper lip; g, rictal gland

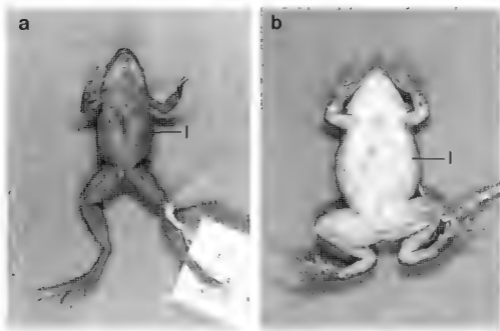


Fig 7 Ventral view of body of (a) *Mmervarya sahyadris*, MNHN 2000 3029, adult female, paratype, Gundiya, Karnataka, (b) *Fejervarya limnocharis*, MNHN 1999 5723, adult female, Sapa, Vietnam. I, fejevryan line

among anurans, the presence on both sides of the belly of a fejevryan line. We do not know of a single other genus of Anura showing this character. As both *Fejervarya* and *Mmervarya* occur in southern India, we think it is more parsimonious to hypothesize a common origin of this character in these two genera than its independent occurrence by homoplasy. In the absence of contradictory information, we regard this character as a synapomorphy of both genera, that suggests that they are sister-genera. Molecular works are currently in progress to test this hypothesis.

**Contents** For the time being, *Mmervarya sahyadris* is the only known species of the genus *Mmervarya*.

**Distribution** The new genus is known from the states of Karnataka and Kerala in south-western India.

**Vernacular name** We propose to use the name "mmervarya" as vernacular name for these frogs, and "fejervarya" for frogs of the genus *Fejervarya*.

**Etymology of the generic nomen** The generic nomen, derived from the Latin adjective *minus*, "very small, the smallest", and from the zoological generic nomen *Fejervarya*, suggests that the new frog looks like a very small fejevrya. Furthermore, the new generic nomen includes the word *Mmeva*, the Latin name of the Greek goddess of wisdom Athena, daughter of Zeus (Jupiter in Latin), who, according to her priests, leapt fully armed from the skull of her father. This evokes the behaviour of these tiny frogs, which suddenly jump, apparently from the mud or the ground, just like under the feet of a walking person.

***Minervarya sahyadris* sp. nov.**

*Holotype*. - MNHN 2000 3031, adult male (SVL 19.1 mm), collected on 25 July 1984 by Alain Dubois along a rivulet in forest near the village of Gundia (13°05'N, 76°07'E; altitude about 200 m), Kempholey forest, Hassan District, Karnataka, India.

*Paratopotypes*. MNHN 2000.3026-3030, 2000.3032-3035, 5 adult males and 5 adult females, collected from 24 to 28 July 1984 by Alain Dubois at the same locality as the holotype.

*Other paratypes*. TBGRI 2001.0002-0007 and ZSI/SRS VA 1105, seven males, collected on 24 August 1999 by S. D. Biju at Mukkam (11°15'N, 75°43'E, altitude about 40 m), Kozhikodu District, Kerala, India; MNHN 2000.3036 and TBGRI 2001.0001, one adult male and one adult female, collected by S. D. Biju on 20 July 2001 in Thiruvannpady area (altitude about 30 m), about 30 km away from Kozhikodu, Kerala, India.

*Description of holotype*. MNHN 2000 3031, adult male (fig 3, 5), from Gundia (Karnataka, India)

(A) Size and general aspect. (1) Specimen of small size (SVL 19.1 mm), body moderately slender.

(B) Head. (2) Head of moderate size, longer (HL 6.1 mm) than wide (HW 7.5 mm, MN 6.74 mm; MFE 5.38 mm; MBE 2.92 mm), convex (3) Snout oval, protruding, its length (SL 3.05 mm) longer than horizontal diameter of eye (EL 2.66 mm). (4) Canthus rostralis rounded, loreal region concave, angle to upper surface of snout scarcely obtuse. (5) Interorbital space flat, larger (IUE 1.75 mm) than upper eyelid (UEW 1.62 mm) and as large as internarial distance (IN 1.75 mm); distance between front of eyes (IFE 3.24 mm) two third of distance between back of eyes (IBE 4.93 mm). (6) Nostrils rounded, with flap of skin laterally, closer to eye (EN 1.30 mm) than to tip of snout (NS 1.43 mm) (7) Pupil indistinct. (8) Tympanum (TYD 1.17 mm) distinct, rounded; about half of eye diameter, tympanum-eye distance (TYE 0.39 mm) one third its diameter. (9) Pineal ocellus absent (10) Vomerine ridge present, bearing few small teeth, between posterior parts of choanae, with an angle of 40° to body axis, closer to choanae than to each other, shorter than distance between them (11) Tongue moderate, oval, slightly emarginate; median lingual process absent (12) Supratympanic fold prominent, from eye to shoulder (13) Parotoid glands absent (14) Cephalic ridges absent. (15) Co-ossified skin absent

(C) Forelimbs. (16) Arm short, rather strong (FLL 3.56 mm), shorter than hand (HAL 3.95 mm), not enlarged. (17) Fingers rather long, thin (TFL 2.27 mm). (18) Relative length of fingers, shortest to longest: IV < II < I < III. (19) Tips of fingers bluntly rounded, not enlarged (20) Fingers without dermal fringe; webbing absent (21) Subarticular tubercles prominent, rounded, single, all present (22) Prepollex oval, prominent; two round, distinct palmar tubercles; supernumerary tubercles absent.

(D) Hindlimbs. - (23) Shanks three times longer (TL 8.1 mm) than wide (TW 2.92 mm), longer than thigh (FL 7.2 mm), but shorter than distance from base of internal metatarsal tubercle to tip of toe IV (FOL 8.7 mm) (24) Toes long, thin; toe IV long (FTL 5.70 mm) more

than one third of distance from base of tarsus to tip of toe IV (TFOL 13.5 mm). (25) Relative length of toes, shortest to longest: I < II < V < III < IV. (26) Tips of toes rounded, not enlarged (27) Webbing rudimentary: I 2 2 1/2 II 2 3 1/3 III 3 4 IV 4 2 2/3 V (MTTF 3.31 mm, MTF 3.37 mm; TTF 5.77 mm; FTF 5.96 mm). (28) Dermal fringe along toe V absent. (29) Subarticular tubercles prominent, oval, simple, all present (30) Inner metatarsal tubercle rather long, very prominent, spike-shaped; its length (IMT 0.72 mm) 2.22 times in length of toe I (ITL 1.59 mm). (31) Inner tarsal ridge present. (32) Outer metatarsal tubercle present, small, rounded, supernumerary tubercles absent; tarsal tubercle absent

(E) Skin - (33) Dorsal and lateral parts of head and body: snout, between the eyes and side of head smooth; back with indistinct, interrupted longitudinal glandular folds; upper part of flanks with glandular warts, lower part of flanks smooth. (34) Latero-dorsal folds absent (one of the dorsal folds in about the same position) (35) Dorsal parts of limbs: forelimbs smooth, thigh, shank and tarsus with indistinct glandular warts. (36) Ventral parts of head, body and limbs: throat and chest with dense glandular warts; belly smooth; thigh ventrally smooth, zone surrounding vent and posterior part of thigh with dense glandular warts. (37) Rectal gland present, just behind mouth commissure.

(F) Coloration in alcohol (38) Dorsal and lateral parts of head and body: dorsal parts of head and dorsum fawn colored, with indistinct mid-dorsal line and lighter longitudinal bands; a large light beige band from posterior border of eye to groin, underlined ventrally by a brown band, loreal region, tympanic region, supratympanic fold and tympanum brown; upper lip with a whitish horizontal band, rectal gland white. (39) Dorsal parts of limbs: forelimbs, thigh, shank and foot beige with brown bands; posterior part of thigh light brown. (40) Ventral parts of head, body and limbs: throat light grey; margin of throat yellowish without spots or bands; chest, belly and thigh yellowish. Vocal sac light grey in its anterior part and yellowish in its posterior part (including throat and chest).

(G) Male secondary sexual characters. - (41) Nuptial spines present, one single patch on prepollex and finger I up to half penultimate phalange numerous, very small, whitish spines. (42) Vocal sac present, unique subgular pouch, marked by glandular skin on middle of throat and anterior chest; a pair of rounded openings in rather posterior part of mouth floor. (43) No other male secondary characters.

*Variation* - Measurements of *minervarya* specimens are given in tab 5-6 Due to the small number of specimens no statistical analysis has been performed All 6 adult males measured are smaller (SVL 17.2-19.1 mm) than the 4 adult females (SVL 20.6-23.0 mm), a sex size dimorphism which, although not testable statistically (DUBOIS, 1984), is probably significant and general in the species. Individuals of different origin seem very similar in their measurements, except concerning the limbs: the forelimb (FLL), hand (HAL), third finger (TFL) and tibia (TL) appear shorter in the specimens of both sexes from Karnataka than in the males from Kerala: at least the two series of measurements do not overlap in range Such a trend would need to be confirmed on much larger series of specimens. In the specimens from Gundia in life, when the hind leg was extended anteriorly along flank, the heel reached a point situated from back of tympanum to slightly beyond back of eye. The series from Kerala is much clearer in coloration, but shows no differentiation in color pattern This variation may be due to storage and age of the specimens. The males from Kerala have a greyish pattern on the throat which

reminds the gular "W" of *fejervarya* males. In the *minervarya* specimens from Karnataka, the greyish zone is much more indistinct. All males have a glandular skin under the vocal sac which extends to the anterior part of the chest. The rectal gland can be observed on all specimens.

*Colours in life* (fig. 4). – Iris clear golden in its upper part, darker in its lower part. Pupilla horizontal oval, continued anteriorly and posteriorly in iris by a dark horizontal bar, and inferiorly by a narrow dark vertical line. Sides of head dark brown, darker in tympanic region. Upper lip with a bright white bar, from snout to below tympanum or posteriorly, particularly bright in its anterior part. Mid dorsum brick red, reddish, reddish brown, brown, greyish or golden, often with a creamish, golden, yellowish or reddish mid-dorsal line or band (indistinct after fixation). Indistinct, discontinuous colored bands on sides of back, especially in its posterior part, in the usual place of latero-dorsal folds in frogs, but supported by folds that are not different from or more prominent than the other longitudinal folds of back. Upper flanks dark greyish with indistinct clearer zones, lower flanks darker. Upper arm brick red or brown. A clear median line sometimes present on upper part of hind leg from vent to heel. Throat translucent or yellowish in its anterior part, followed by a greyish zone, and by a yellow posterior part. Chest and belly bright white, yellow or yellowish. Translucent *fejervaryan* lines quite distinct. Inferior part of thighs translucent or clear yellowish.

*Natural history* – In Karnataka the species was collected in open habitat in forested area (Kempholey forest), in Kerala it was found near paddy fields and in an abandoned quarry. During monsoon (June-July), the males call from terrestrial calling sites, never in water, but always turned towards water (small ponds or rivulets). Calls are rapid sequences of high-pitched "chick . chick . .", reminding the jingling of a bunch of keys. Amplexus is axillary. Eggs masses are attached to aquatic vegetation. They are composed of 20-35 eggs that are 2 mm in diameter and pigmented. Tadpoles (that will be described in detail elsewhere) are typical rapid tadpoles, with unspecialized, ventrally directed mouthparts and a keratodont formula of 1.1+1/1+1.2. In captive condition they were observed to reach metamorphosis within 28 days.

*Etymology of the specific nomen* – The specific nomen is the Sanskrit name *Sahyadris*, meaning "the mountains" (*adri*) "of the Western Ghats" (*Sahyan*): it refers to the area of distribution of the species.

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## APPENDIX I

## COMPARATIVE MATERIAL EXAMINED

Specimens marked with an asterisk (\*) were included in the morphometric analyses (tab. 3-4, fig. 1-2).

- Conraua allent* (Barbour & Loveridge, 1927) - SIERRA LIONA: Region of Loma MNHN 1979 6136-6146
- Conraua beccarii* (Boulenger, 1911) - ETHIOPIA: Gondar, 2000 m MNHN 1933 0021.
- Conraua crassipes* (Büchholz & Peters, 1875) - NIGERIA: Idamu MNHN 1995 5704-5708, 1995 5711, 1995 5715
- Conraua detroit* Huxelmann, 1972 - TOGO: Dangli Anghu MNHN 1978 2026-2031, *Mtsahöhe* MNHN 1993 4084-4087.

- Conraua goliath* (Boulenger, 1906) – EQUATORIAL GUINEA: MNHN 1992.5316
- Euphylectis cyanophictis* (Schneider, 1799). NEPAL Dillikot, 2400 m MNHN 1975 2164\*, 1975 2182\*–2183\*, 1975 2194\*, 1975.2196\*. Samchare MNHN 1977 1364-1403, Sukhet, 900 m MNHN 1996 9274–9280, Tatopani Khola, 2200 m: MNHN 1975.2250-2273
- Euphylectis hexadactylus* (Lesson, 1834). – INDIA: NMW 2512.1\*–5\*, 25121\*.
- Fejervarya greenii* (Boulenger, 1904) SRI LANKA Nuwara Eliya MNHN 2000.0617
- Fejervarya keralensis* (Dubois, 1981) INDIA. Coonoor Nilgiris MNHN 1902 0124-0127, Genji, Coromandel. MNHN 1902.0172.
- Fejervarya limnocharis* (Gravenhorst, 1829) – INDONESIA: Java, Bogor FMNH 256721\*–256724\*. Java, Cianjur, FMNH 256727\*–256728\*, 256732\*, Sumatra, Medan, FMNH 256758\*; Sumatra, Seleukat FMNH 256769\*, Sumatra, Sidikalang FMNH 256762\* LAOS Luang Prabang MNHN 1999 6093 THAILAND: Khao Chong, Trang MNHN 1987 2357-2385. VIETNAM Supa, MNHN 1996.3373 3376
- Fejervarya sylvatica* (Dubois, 1975) NEPAL. Godavari MNHN 1975 1607-1624, Joubasi MNHN 1975 1640-1645.
- Fejervarya nilagirica* (Jerdon, 1853) – INDIA Udthagamangulam, Nilgiris MNHN 1984 2334-2342
- Fejervarya pierrei* (Dubois, 1975). – NEPAL: Birtamode. MNHN 1975 1681-1710
- Fejervarya rufescens* (Jerdon, 1853) INDIA Gudia, Karnataka MNHN 1984.2349-2355.
- Fejervarya sylvatica* (Annandale, 1919) NEPAL Dongitson MNHN 1975 2038-2062, Tu Pami Khola MNHN 1996.9259-9265.
- Fejervarya teraiensis* (Dubois, 1984). – NEPAL: Birtamode. MNHN 1976 1029-1040
- Fejervarya vittigera* (Wiegmann, 1834) – PHILIPPINES Manila MNHN 1900 0435-0437, 1994.0568.
- Hoplobatrachus chinensis* (Osbeck, 1765) [valid nomen of the species often referred to as *Rana rugulosa* Wiegmann, 1834. see KOSUCH et al. 2001, and DUBOIS & OHLER, in preparation] – CHINA “Canton” BMNH 1933 12.4 18\*, Cap Sngmore ZMB 3271\*, Hong Kong: NMW 2614 5\* – LAOS Vientiane, market: MNHN 1997.4900\*. – MYANMAR: Pegu: BMNH 1868.4.3.90\*.
- Hoplobatrachus crassus* (Jerdon, 1853). – INDIA: Madras: BMNH 1872 4 17.245\*.
- Hoplobatrachus occipitalis* (Gunther, 1859) GAMBIA BMNH 1947 2 29 8\* IVORY COAST Soubrié MNHN 1990 4428. Soubrié Samandata MNHN 1993 2845; Tubou. MNHN 1990 4386-4389. LIBERIA Nimba, Grassfield: MNHN 1990 4380-4385
- Indrana brachytarsus* (Gunther, 1876) INDIA Ponnudi, Trivandrum District, Kerala FMNH 217954
- Indrana diplosticta* (Gunther, 1876). – INDIA: Malabar. BMNH 1947 2.3.27
- Limnonectes kuhli* (Tschudi, 1838) INDONESIA Sumatra Sukalang MV 80\*, MV 82\*, MV 102\* 103\*, MV 105\*, MV 108\*, MV 111\*–112\*, MV 117\*, MV 127\*
- Rana (Climotarsus) curtipes* Jerdon, 1853. – INDIA: Thekaddi, Periyar, Tiger Reserve, Kerala: MNHN 1989 2751
- Rana (Hydrophylax) malabarica* Tschudi, 1838 INDIA Bengal MNHN 4439, 1989 3448, Malabar MNHN 771, 4440, 1989.3451-3452
- Rana (Sylvirana) gracilis* Gravenhorst, 1829. – SRI LANKA Belhuloya: MNHN 2000.0614
- Rana sylvatica*, *imporata* Gunther, 1864 INDIA Coonoor, Nilgiris MNHN 1902 0128, Gudia, Karnataka: MNHN 1985 584-586. – SRI LANKA Kitulgala: MNHN 2000 0613.
- Sphaerotheres phyllalis* (Jerdon, 1853) [valid nomen of the species often referred to as *Rana brevipes* Schneider, 1799 see DUBOIS, 2000, and DUBOIS & OHLER, in preparation] INDIA Madras BMNH 1874 4 29\*, 1947.2 28 55\*–56\*, 1947 2 28 58\* MSNG 28519\* MYANMAR North Chin Hills BMNH 1893 11 17 4\* NEPAL Barmorang MNHN 1997 5100\*–5119\*, Tekumala MNHN 1983 0808\*–0812\* PAKISTAN Lower Hub River MNHN 9624\*, 9626\* SRI LANKA BMNH 1877 3 9 8\*, Kurungala, 1973.3024\*.

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